LEADING EFFECTIVE AFROCENTRIC PARTICIPATION (LEAP) PROJECT PHASE I

Kenya National Maritime GHG Emission Inventory

LEAP TASK 1

Nuru Mohamed, Dolapo Oluteye, Fitzroy Meyer-Petgrave

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By:

Nuru Mohamed, Dolapo Oluteye, Fitzroy Meyer-Petgrave

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List of Abbreviations

AfCFTA	African Continental Free Trade Agreement
AIS	Automatic Identification System
CO2	Carbon Dioxide
DWT	Deadweight Tonnage
EAC	East African Community
ECA	Emission Control Area
GHG	Greenhouse Gas

GFI	GHG Fuel Intensity
HS	Harmonized System
IEA	International Energy Agency
HIS	Information Handling Services
IMO	International Maritime Organization
KMA	Kenya Maritime Authority
LAPSSET	Lamu Port South Sudan Ethiopia Transport
LEAP	Leading Effective Afrocentric Participation
LNG	Liquefied Natural Gas
MMSI	Maritime Mobile Service Identity
NM	Nautical Miles
PATNA	Professional African Technical Network Advisory
TJ	Terajoules
TEU	Twenty-foot Equivalent Unit
UCL	University College London
UNCTAD	United Nations Committee on Trade and Development
WtW	Well-to-Wake
TtW	Tank-to-Wake

Authors

Nuru Mohamed[1]
Dolapo Oluteye[2,3]
Fitzroy Meyer-Petgrave[3]

[1] Kenya Maritime Authority
[2] University College London (UCL), United Kingdom
[3] The PATNA Initiative

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Disclaimer

Contact details

If you require any further information on this report, please contact: Dr. Dola Oluteye - dola@thepatna.org or The PATNA Initiative research team – research@thepatna.org

About The Professional African Technical Network Advisory (PATNA) Initiative

The PATNA Initiative is a non-profit network of 100+ African experts, policymakers, researchers, and advocates, formed to amplify Africa's voice in global energy transition and climate action. PATNA leverages evidence-based research to inform policies that balance economic growth with environmental protection. Bringing together academics, technical experts, government professionals, and private-sector cohorts, we ensure that African perspectives are represented in global policy and climate matters. For more information, please visit www.thepatna.org.

About UCL Energy Institute

The UCL Energy Institute hosts a world leading research group which aims to accelerate the transition to an equitable and sustainable energy and trade system within the context of the ocean. The Shipping and Oceans Research Group's multi-disciplinary work on the shipping and ocean system leverages advanced data analytics, cutting-edge modelling, and rigorous research methods, providing crucial insights for decision-makers in both policy and industry. The group focuses on three core areas: analyzing big data to understand the drivers of shipping emissions, developing models and frameworks to explore the path toward zero-emission shipping, and conducting social science research to examine the policy and commercial structures that enable the decarbonization of the shipping sector. For more information visit www.shippingandoceans.com.

About Kenya Maritime Authority

The Kenya Maritime Authority (KMA) is a State Corporation established under the Kenya Maritime Authority Act, 2006. The Authority is mandated to regulate and coordinate maritime affairs in Kenya, including the promotion of maritime safety, protection of the marine environment, and facilitation of maritime trade. KMA works closely with international organizations, regional bodies, and industry stakeholders to ensure Kenya's maritime sector operates in accordance with international standards and best practices.

Executive Summary

This report presents Kenya's first voyage-based national maritime greenhouse gas (GHG) emissions inventory, developed under Task 1 of the Leading Effective Afrocentric Participation (LEAP) Project. Using Automatic Identification System (AIS)-derived vessel activity data and methodology aligned with the Fourth IMO GHG Study, the inventory quantifies energy demand and CO2 emissions from both international and domestic shipping activity at Kenyan ports for the reference year. The findings are intended to strengthen Kenya's evidence base for IMO negotiations and inform the development of a nationally appropriate maritime decarbonisation strategy.

International shipping accounts for the majority of Kenya's maritime emissions. Among vessel types, container ships are the dominant source, generating 5,774.9 TJ in energy demand and 446,941.9 tonnes of CO2 on arrivals alone, figures that reflect Kenya's position as a major containerised trade gateway for East and Central Africa. Bulk carriers and oil tankers are the next most significant contributors, consistent with the country's commodity import profile, which is dominated by petroleum products and bulk agricultural inputs.

At the port level, the Port of Mombasa accounts for approximately 99% of both energy demand and CO2 emissions across international arrivals and departures, underscoring its structural dominance in Kenya's maritime system. While this concentration reflects Mombasa's established role as a regional hub, it also signals a degree of infrastructural and emissions risk associated with over-reliance on a single port. The comparatively low activity recorded at Lamu, Malindi, and Shimoni points to an underutilised network that, if strategically developed, could support a more resilient and lower-emission port system.

Analysis by partner country reveals that the United Arab Emirates, Singapore, and Sri Lanka are the top sources of arrival-related emissions, with the UAE alone contributing 2,227.3 TJ in energy demand and 172,464.3 tonnes of CO2. On the departures side, the United Republic of Tanzania, India, and South Africa feature prominently. These bilateral trade corridors represent priority areas for engagement on fuel transition and green shipping corridors, particularly under frameworks such as the IMO's net-zero strategy and the African Continental Free Trade Agreement (AfCFTA).

Domestic shipping, while modest in its absolute contribution, totalling 129 TJ in energy demand and 9,740 tonnes of CO2, is not without significance. The Mombasa–Lamu route alone accounts for the highest domestic energy demand (60.4 TJ) and CO2 emissions (4,540.5 tonnes), driven by bulk carrier activity. Given the relatively small fleet size involved, targeted interventions on this corridor could achieve measurable emissions reductions at low cost.

Taken together, these findings present a clear set of priorities for Kenya's maritime decarbonisation agenda: managing and optimising emissions at the Port of Mombasa; pursuing port diversification to distribute maritime activity more equitably; engaging key trading partners on sustainable shipping practices; and developing targeted policy measures for high-emission domestic routes. Kenya's commitment to building a robust national evidence base, as demonstrated by this inventory, positions it as a credible and proactive participant in Africa's collective engagement with the IMO on the global shipping energy transition.

1. Introduction to the LEAP Project

The Leading Effective Afrocentric Participation (LEAP) project is an initiative focused on empowering Africa's voice in the International Maritime Organization (IMO) climate negotiations. This effort comes at a critical time when the IMO's 2023 Revised GHG Strategy has outlined ambitious goals for achieving net-zero emissions by 2050. These include the phase-out of fossil fuels and a reduction of greenhouse gases (GHGs) by 70-80% by 2040. To meet these targets, significant advancements in energy efficiency and the adoption of zero-emission fuels are required.

The IMO's 2023 Revised Strategy places international shipping at the cusp of a strong, equitable mitigation action that would stimulate rapid decarbonization not just within shipping but could also lead the way to equitable mitigation in many other sectors. To secure this outcome, the IMO's legally binding policy measures, due for adoption in 2025, need a few key features that are currently under negotiation

Transitioning to a greener and more sustainable maritime sector promises to spur economic transformation, generate employment, and establish Africa as a leader in green and sustainable maritime. African ocean and climate champions have an opportunity to play a critical role in the IMO debates. To date, there has been limited but increasing engagement of African countries in the IMO's GHG negotiations.

The goal of this project is to amplify and strengthen the African negotiating positions at the IMO on the strategy to reducing the GHG emissions in shipping. The project aims at galvanizing and improving Africa's leadership and participation at the IMO with evidence-based rigorous analytical exercise. The project outlines a 5-step technical analyses-based process designed and scoped as a first phase/step to support and inform African policymakers' interventions and negotiating position, starting with six (6) case study countries. The project is being implemented in Kenya, Ghana, Liberia, Malawi, Namibia and Nigeria.

The project is divided into 5 tasks as below:

1. National Shipping Emission Inventory;
2. Develop knowledge of each country's economic potential from a transition to low carbon shipping;
3. Analysis of DNV impact on the fleet and UNCTAD impact on States;
4. Conduct additional case studies to complete the CIA;
5. MEPC 82 negotiation support in the IMO.

This report will cover task 1 of the LEAP Project on Kenya National Shipping inventory.

2. Task 1: Kenya National Shipping Emission Inventory

Task 1 of the LEAP project is designed to frame Kenya's maritime transport supply by developing a comprehensive inventory of shipping emissions and activities. This involves understanding both international and domestic shipping segments, identifying key routes, and analyzing emissions and transport volumes per segment. The objective is to position Kenya as a leader in sustainable maritime practices and to strengthen its negotiating stance within the IMO.

The execution of Task 1 relies on collaboration between the Kenya Maritime Authority (KMA) and University College London (UCL). KMA's expertise in national maritime operations complements UCL's technical capacity to provide data-driven insights. Together, these stakeholders aim to bridge data gaps, establish robust emission inventories, and produce actionable strategies for Kenya's maritime decarbonization. By leveraging such partnerships, the project seeks to align Kenya's maritime policies with global sustainability goals, ensuring that its unique economic and environmental contexts are adequately represented on the international stage.

2.1 Kenya's National Maritime Context

The maritime domain is the cornerstone of the livelihood of humanity, habitat, resources and transport routes for up to 90 per cent of global trade. The strategic location of Kenya's coastline along major global maritime routes offers substantial opportunities for growth in maritime transport and services.

Kenya's maritime sector is a critical economic pillar serving approximately 300 million people in East Africa. Major ports and trade routes position the country as a regional hub.

2.1.1 Major Ports

Kenya's coastline is home to strategic ports that are pivotal to regional and international trade.

a) <u>Port of Mombasa</u>

The Port of Mombasa is the gateway to East and Central Africa and is one of the busiest Ports along the East African coastline. The Port provides direct connectivity to over 80 Ports worldwide and is linked to a vast hinterland comprising Uganda, Rwanda, Burundi, Eastern Democratic Republic of Congo, Northern Tanzania, Southern Sudan, Somalia and Ethiopia by road. It handles a variety of cargo, including containerized goods, petroleum products, bulk grain, and vehicles. The port's strategic location connects Kenya to key trading partners in Asia, the Middle East, and Europe.

b) <u>Lamu Port</u>

The port is a major component of the Lamu Port South Sudan Ethiopia Transport (LAPSSET) corridor project and the second commercial port in the country. The first three berths of the envisaged 23 berths port are already complete with operations at berth one dedicated for containerized cargo underway. The multipurpose port comprises modern berths for handling containerized, general cargo, liquid bulk, coal, Liquefied Natural Gas (LNG) and product oil. Each berth has a quay length measuring 400 metres with a depth of minus 17.5 metres capable of comfortably docking panamax and post panamax vessels with a capacity of over 10,000 TEUs. The port, which is among the biggest in the African continent, is strategically located at the middle of major shipping routes with the deep-water harbour on the east coast of Africa, thus being a premier transshipment hub for all cargo destined for the continent. It is designed to complement Mombasa Port by catering to transshipment cargo and serving landlocked countries such as South Sudan and Ethiopia.

c) Port of Kisumu

The Port of Kisumu is situated on Lake Victoria, an inland port primarily meant to support regional trade with neighboring countries like Uganda and Tanzania. The transit port focusses on transit cargo from Mombasa to the EAC region; the export of regional products and import of local products from Uganda and Tanzania, passenger ferrying and a logistics hub. The Port of Kisumu occupies 17.5 hectares of land with an annual cargo handling capacity of 25,000 TEUs. The port has recently undergone massive rehabilitation works including dredging of the channel to accommodate larger vessels, upgrade of physical infrastructure and the improvement of safety and reliability of the lake transport system. Currently, the port has a berth length of 300 meters and is envisaged to get an additional 400 meters of docking area upon completion of dredging.

2.2 Key Commodities and Seaborne Trade Routes

Kenya's maritime trade is characterized by diverse commodities and vital trade routes. Commodities which include agricultural products such as tea, coffee, and horticultural goods dominate Kenya's exports, alongside minerals and fish products. Other products form major import commodities include petroleum products, machinery, industrial equipment, and consumer goods.

Kenya's maritime routes link it to major global trade hubs, with the Western Indian Ocean serving as a critical pathway. Routes connect to the Middle East (notably the United Arab Emirates and Saudi Arabia) for petroleum and chemicals, Asia (China and India) for manufactured goods, and Europe for mixed cargo trade. The Northern Corridor extends inland from Mombasa, facilitating trade to Uganda, Rwanda, and the Democratic Republic of Congo, further underscoring the country's regional importance.

Kenya's commitment to decarbonization includes the establishment of a dedicated ministry for the marine and blue economy in 2023, signaling intent to align with global energy transition goals.

3. Methodology

The research seeks to assess the Kenya's National Shipping Emission Inventory, identify the status of emission and give recommendations on areas for further improvement. The section opens by setting-out the methods applied in data collection, analysis, and presentation of the results.

3.1 AIS-Derived Estimates of Vessel Activity

The Automatic Identification System (AIS) provides critical data for analyzing vessel activity. As part of the LEAP project, UCL has supplied AIS datasets, which enable comprehensive insights into both international and domestic voyage inventories. These datasets facilitate a granular understanding of shipping operations by tracking vessel movements, operational patterns, and emissions on an hourly basis.

3.2 IMO 4th GHG Study Methods

The methodology for estimating shipping emissions in this project aligns with the approaches outlined in the Fourth IMO GHG Study. This study employs both 'bottom-up' and 'top-down' methods to estimate fuel consumption and greenhouse gas emissions.

3.2.1 Bottom-Up Approach

This is a method that utilizes AIS-transmitted data to monitor individual vessel operations. Key metrics include time spent at sea, distance traveled, and operational speed.

Fuel consumption and emissions are calculated hourly per vessel, using vessel specific data from the Information Handling Services (IHS) database. Emissions are allocated to international or domestic activity based on identified port calls and voyage routes, in line with IPCC guidelines.

3.2.2 Top-Down Approach

This method uses global fuel consumption statistics from the International Energy Agency (IEA). Emissions are estimated using emission factors derived from pollutant mass per unit of fuel consumption.

A comparison of these approaches, alongside quality assurance procedures, ensures robust and consistent results.

3.3 Summary of Methods Underpinning the Datasets

The Fourth IMO GHG Study outlines the following key steps in the bottom-up methodology:

- Module 1 is on Vessel Technical Specifications Pre-Processing. This module handles data gaps in vessel specifications and assigns assumptions for fuel types and size categories.
- Module 2 is about matching AIS Data with Technical Specifications. Vessels identified in AIS datasets are mapped to IHS databases using unique identifiers such as IMO or MMSI numbers. This ensures comprehensive coverage of vessel activity.
- Module 3 works on AIS Data Cleaning and Processing. This module ensures data integrity by addressing missing values, filtering inconsistencies, and resampling data to provide annualized hourly observations.

- Module 4 presents the Domestic vs. International Emissions Allocation where emissions are allocated based on voyage-specific criteria, distinguishing between domestic and international activity.
- Module 5 is an Emissions Estimation Model. It estimates fuel consumption and emissions, considering operational phases and compliance with Emission Control Area (ECA) standards.
- Module 6 provides Aggregated Emissions Estimates which is a combination of data from earlier modules to produce annual statistics on emissions by vessel type, size, and activity.

Each raw dataset contains the following key data fields:

a. n_vys - Number of voyages captured.
b. n_imo - Number of distinct IMO numbers/vessels.
c. aby_dwt_nm - Average build year of vessels servicing the country,
d. weighted by deadweight-tonne nautical miles.
e. tps_dwt_nm - Transport supply, deadweight-tonne nautical miles.
f. ene_tj - Energy demand, TJ.
g. co2_t - Carbon dioxide, tonnes, excluding other greenhouse gases.
h. co2_g_p_dwtnm - Carbon intensity, grams of CO2 per deadweight-tonne nautical-mile.

4. Results

4.1 International AIS-based Voyage Inventories by Vessel Type

The international AIS-based voyage inventories disaggregated by vessel type, covers both arrivals and departures at Kenyan ports. The analysis draws on AIS data to quantify key metrics, including the number of voyages, distinct vessel identifiers, average build year weighted by deadweight-tonne nautical miles, transport supply, energy demand in terajoules, carbon dioxide emissions in tonnes, and carbon intensity in grams of CO2 per deadweight-tonne nautical mile. Together, these metrics provide a comprehensive picture of each vessel category's contribution to Kenya's maritime carbon footprint.

Table 1: International Arrivals Inventory by Vessel Type

International Arrivals Inventory - by Vessel Type							
Vessel Type	n_vys	n_imo	aby_dwt_nm	tps_dwt_nm	ene_tj	co2_t	co2_g_p_dwtnm
Container	538	118	2004.7	45973699706	5774.9	446941.9	9.7
Bulk carrier	274	251	2010.3	43616557992	2314.7	179207.6	4.1
Oil tanker	94	74	2011.6	23396254839	1368.9	105983.5	4.5
Vehicle	157	106	2009.3	5779106680	1171.5	90748.1	15.7
Chemical tanker	87	59	2006.6	10955325065	978.2	75745.7	6.9
General cargo	117	81	2007.3	5727504401	641.7	49362.4	8.6
Ro-Ro	58	9	2011.3	2215835572	350.6	27069.9	12.2
Liquefied gas tanker	27	8	2014.5	957815902	215.5	16445.2	17.2
Service - tug	12	7	2006.6	12905429.1	34.4	2582.7	200.1
Offshore	6	6	1995	9115190.1	31.3	2352.8	258.1
Service - other	7	7	1984.5	11087435.4	23.1	1737.8	156.7
Cruise	4	3	2001	4386747.3	16.3	1262.7	287.8
Miscellaneous - fishing	4	3	1981.3	1599552.4	15.3	1148	717.7
Ferry-RoPax	2	2	2013.8	195278.1	5.2	394.1	2018.2

Total	**1,38 7**	**734**	**n/a**	**138,661,389, 789**	**12,942**	**1,000,982**	**n/a**

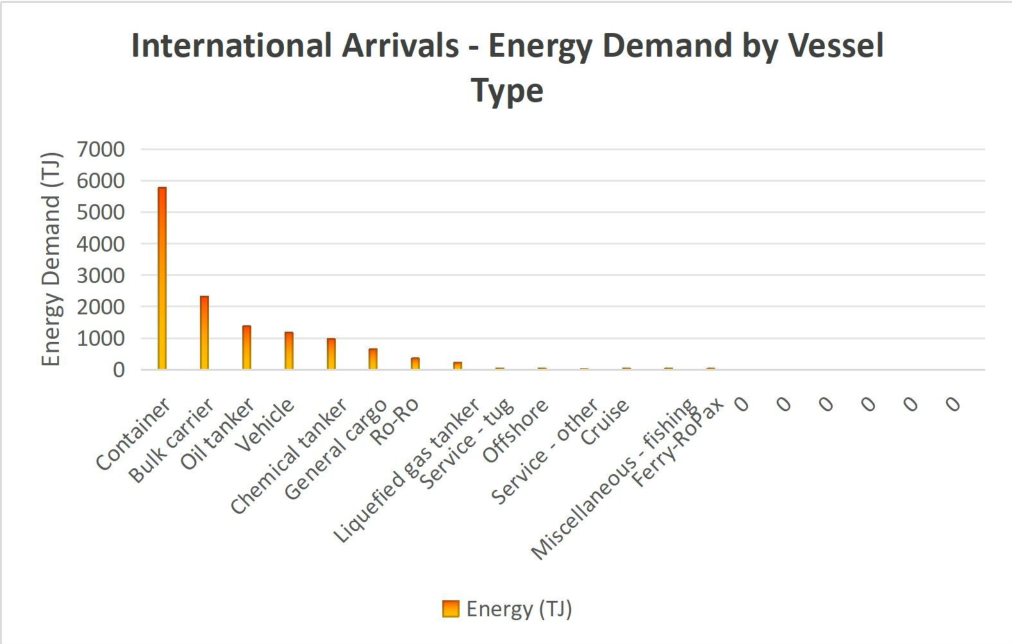

Figure 1: Graph of International Arrivals Energy Demand by Vessel Type

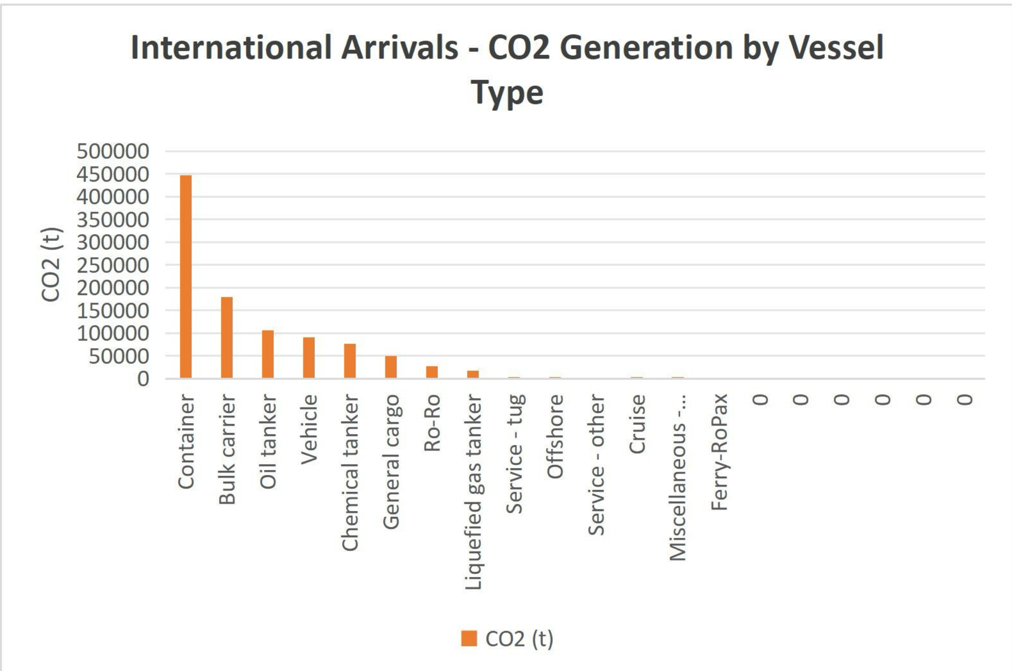

Figure 2: Graph of International Arrivals showing Carbon Dioxide Generation by Vessel Type

Table 2: International Departures Inventory by Vessel Type

International Departures Inventory - by Vessel Type							
Vessel Type	**n_vys**	**n_imo**	**aby_dwt_nm**	**tps_dwt_nm**	**ene_tj**	**co2_t**	**co2_g_p_dwtnm**
Container	538	118	2003.7	26424597854	3340.3	258409.9	9.8
Bulk carrier	274	251	2010.2	28478706570	1357.2	105060.4	3.7
Oil tanker	94	74	2011.7	23374441932	1312.8	101672.5	4.3
Vehicle	157	106	2006	5167865742	994.1	77006	14.9
Chemical tanker	87	59	2005.5	9482679139	844.3	65361.9	6.9
General cargo	117	81	2006.4	3481788655	428	32843.4	9.4
Ro-Ro	58	9	2011.6	2617667543	344.3	26599.4	10.2
Liquefied gas tanker	27	8	2015.2	758813950	163.3	12441.9	16.4
Offshore	6	6	1991.9	6642159.1	35.1	2634.4	396.6
Cruise	4	3	2003	9837728.8	30.3	2349.2	238.8
Service - tug	12	7	2007	5807894.6	22.9	1721	296.3
Service - other	7	7	1985.4	8524848	19.3	1451.1	170.2
Miscellaneous fishing	4	3	1979.2	1499710.8	8.9	670.5	447.1
Ferry-RoPax	2	2	2013.4	351933.4	1.6	120.2	341.6
Total	**1,38 7**	**734**	**n/a**	**99,819,225,65 9**	**8,902**	**688,342**	**n/a**

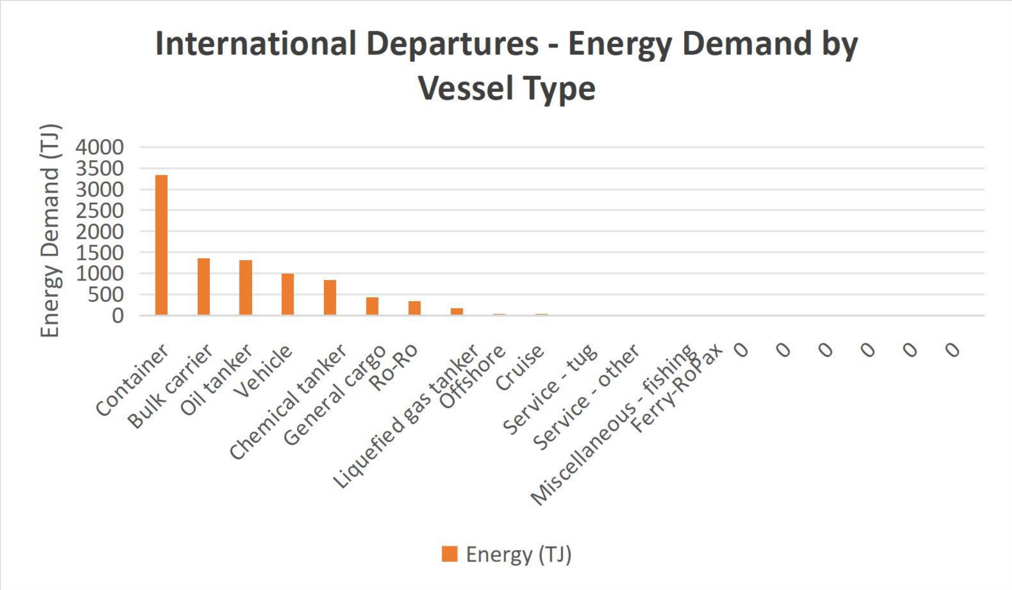

Figure 3: Graph of International Departures Energy Demand by Vessel Type

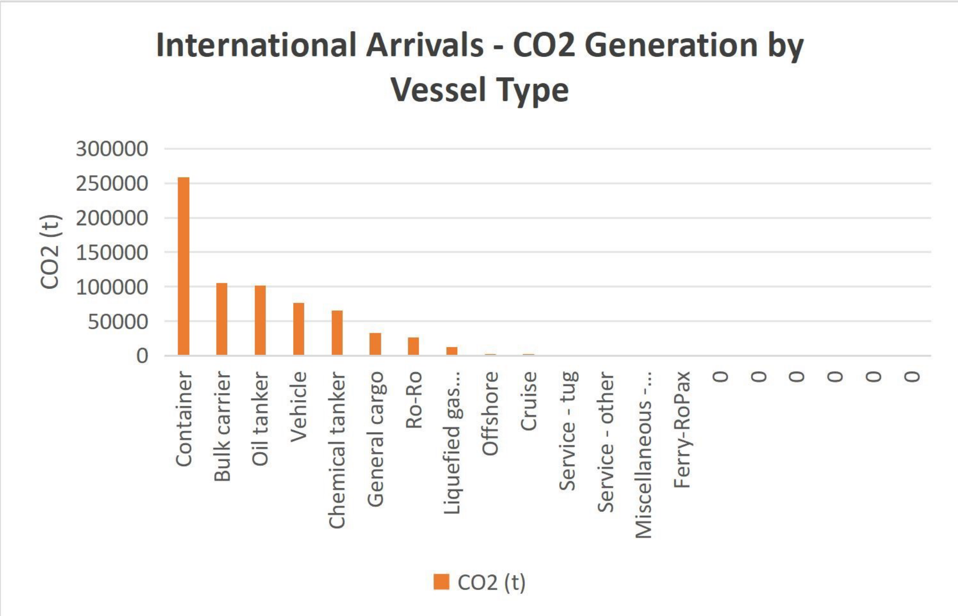

Figure 4: Graph of International arrivals Carbon Dioxide Generation by Vessel Type

Analysis of international arrivals and departures highlights the dominance of container ships, bulk carriers, and oil tankers in energy demand and carbon dioxide emissions. For arrivals, container ships accounted for the highest energy demand (5774.9 TJ) and CO_2 emissions (446,941.9 tonnes), while similar trends were observed in departures (3340.3 TJ and 258,409.9 tonnes, respectively). Bulk carriers and oil tankers followed as significant contributors.

Smaller vessel types, such as general cargo and Ro-Ro ships, displayed lower energy demands but higher emissions intensity relative to their transported cargo capacity. Container ships, tankers, and bulk carriers dominate emissions and energy use.

4.2 International AIS-based Voyage Inventories by Port

This section disaggregates international voyage inventories by port of call, enabling an assessment of how maritime emissions are distributed across Kenya's coastal infrastructure. The analysis covers arrivals and departures at the five identified ports including Mombasa, Shimoni, Malindi, Lamu, and Siaya, and presents the same key metrics as Section 4.1, including energy demand, CO2 emissions, and carbon intensity. The port-level breakdown is critical for identifying where targeted decarbonization interventions would have the greatest national impact.

Table 3: International Arrival Inventory by Port

	International Arrivals Inventory - by Port						
Port Name	**n_vys**	**n_imo**	**aby_dwt_nm**	**tps_dwt_nm**	**ene_tj**	**co2_t**	**co2_g_p_dwtnm**
Mombasa	1364	725	2008.3	1.37992E+11	12872.1	995617.9	7.2
Shimoni	5	5	2003.9	314661637	37	2855.6	9.1
Malindi	7	6	2005.2	320164444.7	24.7	1902.3	5.9
Lamu	10	5	1998	6760178.9	5.4	407.7	60.3
Siaya	1	1	1999	27860504.8	2.6	198.9	7.1
Total	**1,387**	**n/a**	**n/a**	**138,661,389,78 9**	**12,942**	**1,000,982**	**n/a**

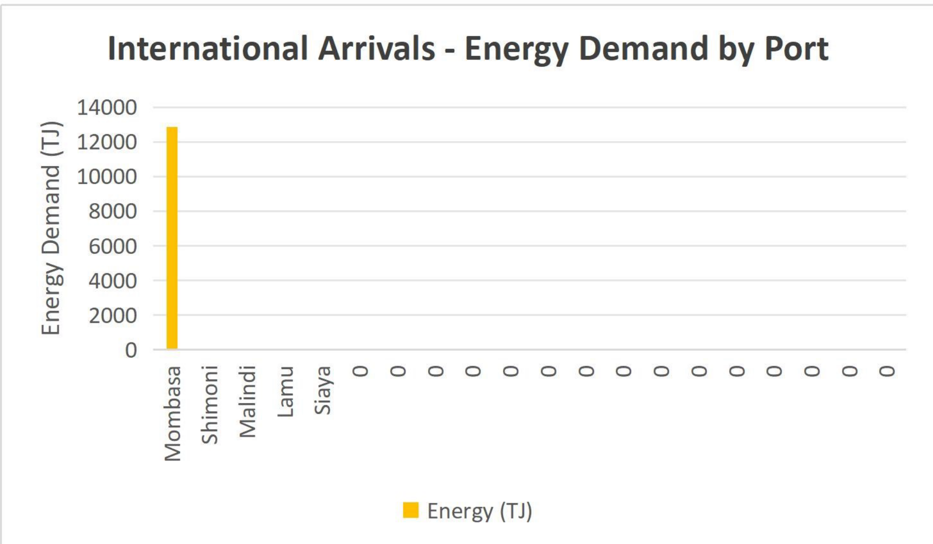

Figure 5: Graph showing International Arrivals Energy Demand by Port

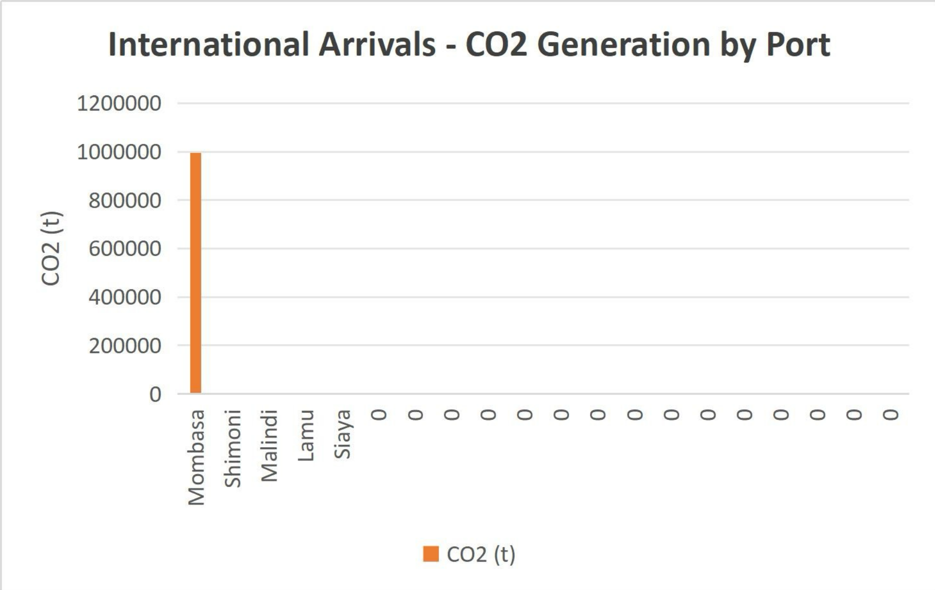

Figure 6: Graph Showing International Arrivals Carbon Dioxide Generation by Port

Table 4: International Departures Inventory by Port

International Departures Inventory - by Port							
Port Name	**n_vys**	**n_imo**	**aby_dwt_nm**	**tps_dwt_nm**	**ene_tj**	**co2_t**	**co2_g_p_dwtnm**
Mombasa	1365	723	2008.1	99488400731	8855.4	684730	6.9
Shimoni	5	5	2006.8	174262889.4	17	1314.3	7.5
Lamu	12	8	2010.3	57050436.8	16.7	1265.7	22.2
Malindi	4	4	2007	75925782.4	10.3	791.3	10.4
Siaya	1	1	1999	23585819.3	3.1	240.7	10.2
Total	**1,387**	**n/a**	**n/a**	**99,819,225,65 9**	**8,903**	**688,34 2**	**n/a**

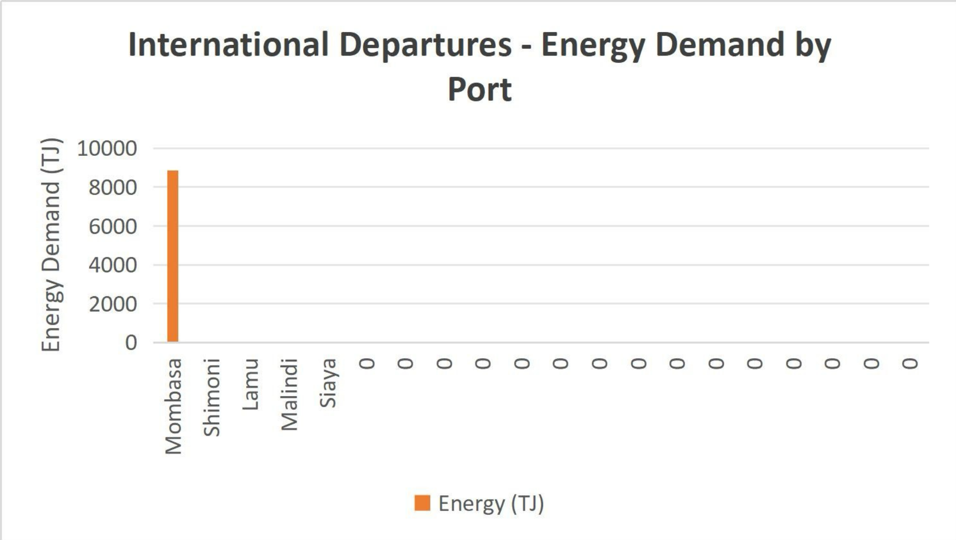

Figure 7: Graph showing International Departures Energy Demand by Port

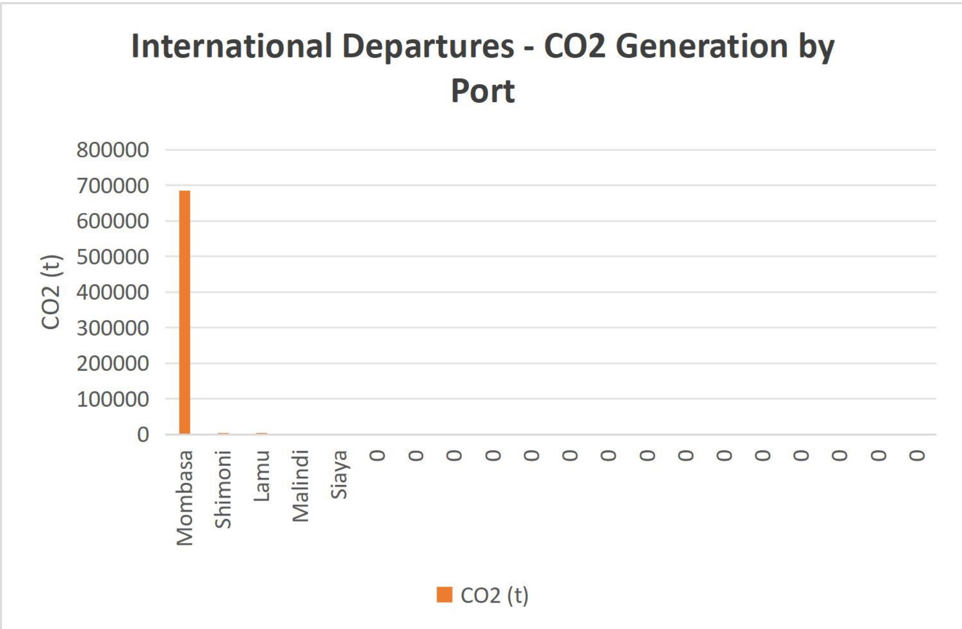

Figure 8: Graph of International Departures Carbon Dioxide Generation by Port

Mombasa's central role as a cargo hub is evident, with 99% of the energy demand and CO_2 emissions from both international arrivals and departures being attributed to this port. The limited activity in secondary ports such as Lamu and Malindi underscores the potential to decentralize shipping activities.

4.3 International AIS-based Voyage Inventories by Partner Country

The international voyage inventories by country of origin for arrivals and country of destination for departures, reveals the bilateral trade relationships that drive Kenya's maritime emissions. By attributing energy demand and CO2 emissions to individual partner countries, the analysis identifies which trading relationships carry the highest emissions burden and, consequently, where diplomatic and technical collaboration on sustainable shipping practices could yield the greatest reductions.

Table 5: International Arrivals Inventory by Partner Country

International Arrivals Inventory - by Partner							
Partner Country	**n_vys**	**n_imo**	**aby_dwt_nm**	**tps_dwt_nm**	**ene_tj**	**co2_t**	**co2_g_p_dwtnm**
United Arab Emirates	185	130	2008.9	26957444024	2227.3	172464.3	6.4
Singapore	128	95	2009.9	19768081978	2114.2	163645.2	8.3
Sri Lanka	117	60	2004	12589345848	1467.8	113684.7	9
Malaysia	56	30	2007.2	9375438009	971.1	75185	8
Saudi Arabia	67	48	2011	13468674252	924.6	71462.2	5.3
Oman	72	31	2009.1	7975128569	759.4	58813.8	7.4
United Republic of Tanzania	278	156	2004.2	2250745289	564.8	43416.6	19.3
Djibouti	43	26	2006.9	5074910049	486.8	37669.6	7.4
India, excluding Sikkim	48	42	2007.3	5301467799	484.6	37492.5	7.1
Mozambique	77	37	1999.2	2696068692	356.4	27486.4	10.2
South Africa	57	50	2009.2	4728469081	350.5	27100.8	5.7
Russian Federation	15	15	2012	4612370462	243.8	18886.4	4.1
Turkey	14	14	2009.8	3500088414	189.5	14672.6	4.2
Egypt	15	15	2012.4	3047941233	175.5	13576.7	4.5
China	8	8	2006.3	1553453491	116.5	8991.6	5.8
Mauritius	11	9	2003.9	689553406.7	103.9	8018.7	11.6
Iran	10	5	2004.1	829216814.9	81.4	6276	7.6
Ukraine	6	6	2009	1228437193	76.8	5943.8	4.8

Pakistan	9	8	2007.5	1044398090	76.4	5919.5	5.7
Spain	4	4	2005.9	932524473.9	74.9	5803.5	6.2

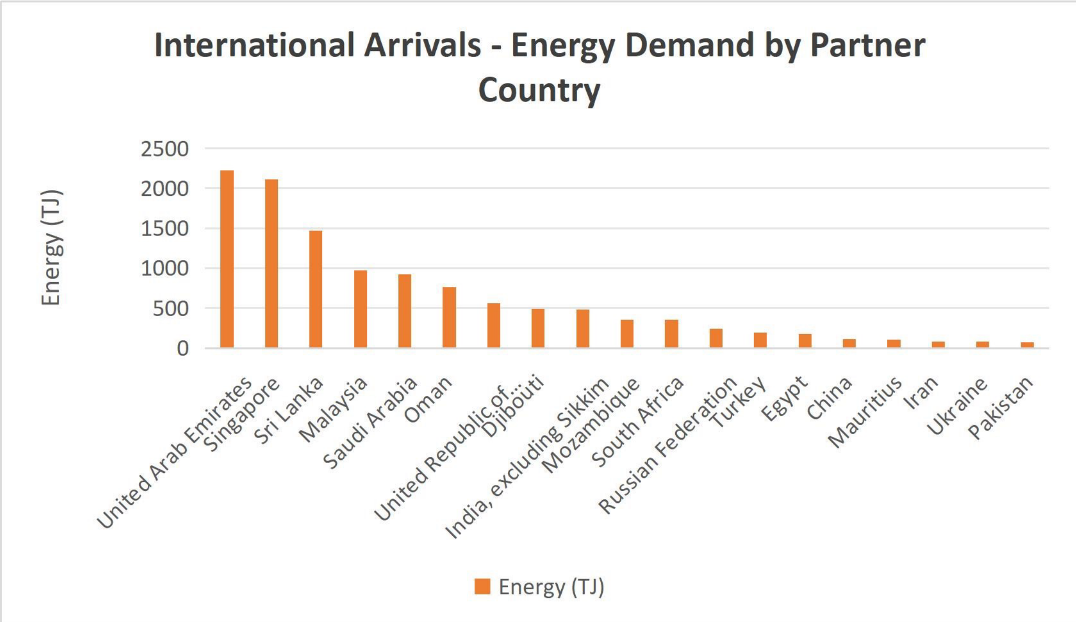

Figure 9: Graph of International Arrivals Energy Demand by Partner Country

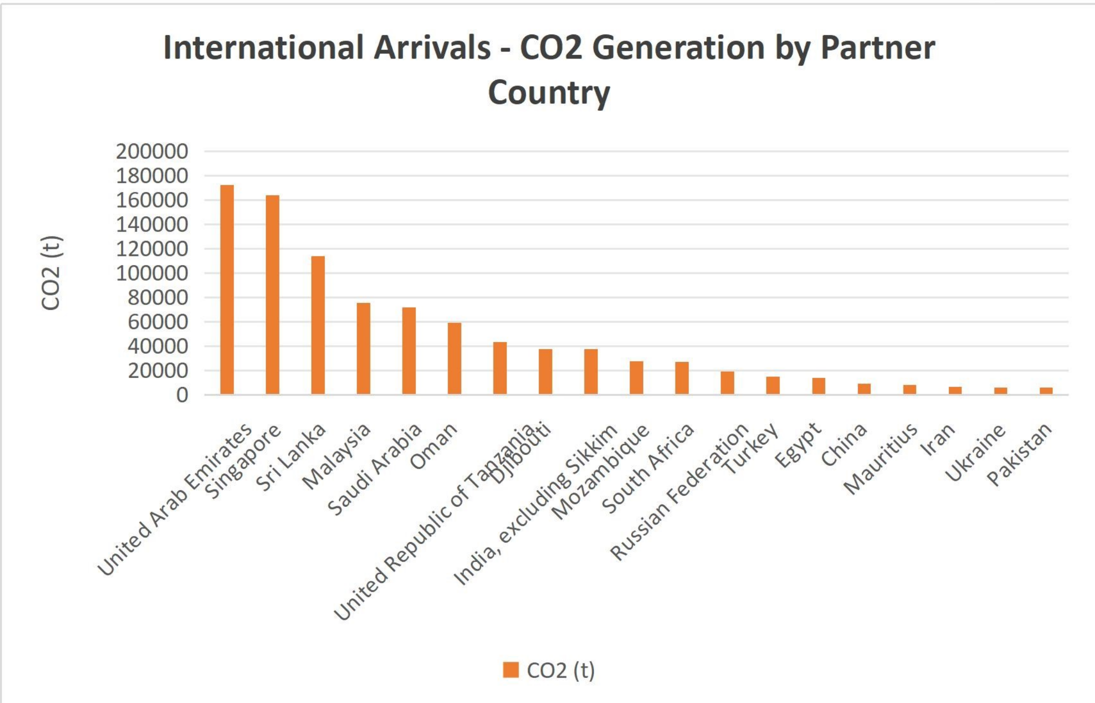

Figure 10: Graph showing International Arrivals Carbon Dioxide Generation by Partner Country

Table 6: International Departures inventory by Partner Country

International Departures Inventory - by Partner							
Partner Country	**n_vys**	**n_im o**	**aby_dwt_ nm**	**tps_dwt_nm**	**ene_tj**	**co2_t**	**co2_g_ p_dwt nm**
United Arab Emirates	100	91	2010.3	19226278416	1266.5	98093.6	5.1
United Republic of Tanzania	494	235	2005.6	3658839336	928	71416.3	19.5
India, excluding Sikkim	72	35	2008.9	7942923136	862.1	66777.7	8.4
Sri Lanka	60	21	2000.5	7686499525	779	60338.5	7.8
South Africa	154	151	2009.9	14743466843	750.9	58081.3	3.9
Singapore	47	42	2008.3	5961021501	682.1	52806.3	8.9
Saudi Arabia	41	27	2008.1	6800884749	605.3	46868.7	6.9
Oman	60	21	2006.7	4277601729	523.8	40572.7	9.5
Mozambique	88	73	2010.2	3683854276	320.9	24662.4	6.7
Indonesia	15	4	1998.9	2466993326	212.7	16469.8	6.7
Malaysia	11	10	2003.8	2504272929	199.9	15470.7	6.2
Somalia	66	24	1995.8	854229284.1	168.7	12978.8	15.2
Djibouti	16	14	2006.5	2035951422	159.3	12320.3	6.1
Brazil	7	7	2012.1	2162516780	109.2	8453.6	3.9
Thailand	6	5	2009.8	558179095.8	101.5	7865	14.1
Spain	3	3	2002.5	841772423.6	86.2	6669.9	7.9
Uruguay	5	5	2013.7	1937542030	74.8	5796.2	3
Madagascar	17	16	2009.3	428993613.4	70.7	5469.8	12.8
Turkey	3	3	2001.8	424080989.8	53.7	4160.9	9.8
Seychelles	4	4	2002.5	9679598.4	50	3821.1	394.8

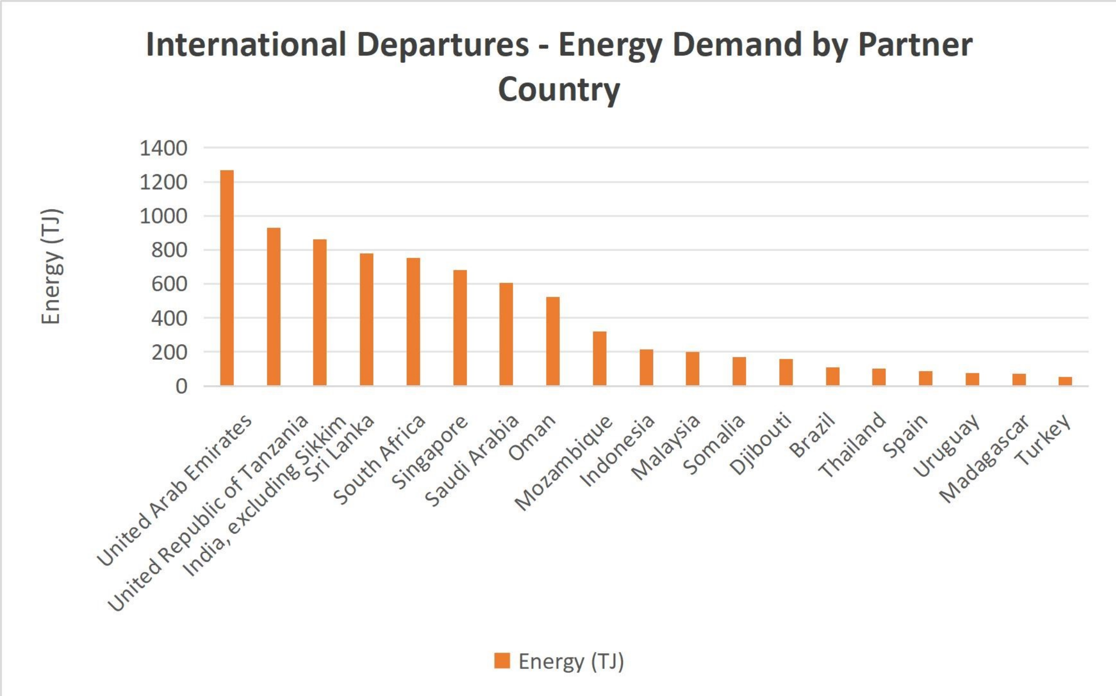

Figure 11: International Departures Energy Demand by partner Country

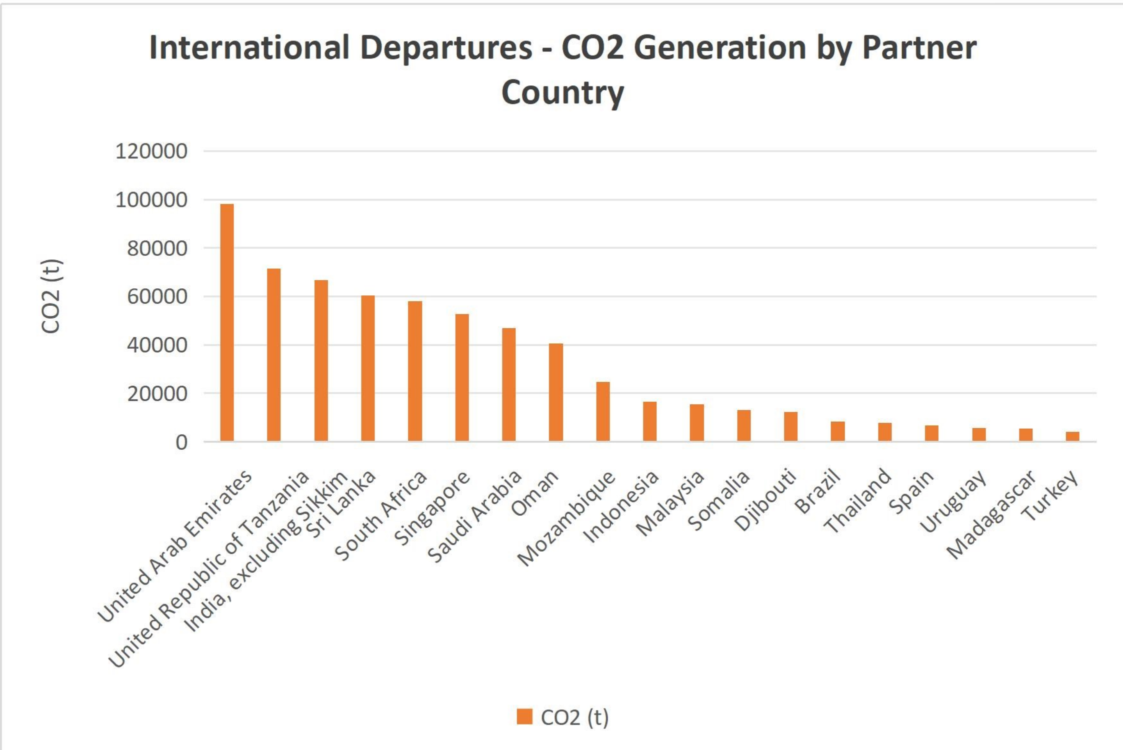

Figure 12: Graph showing International Departures Carbon Dioxide Generation by Partner Country

Key trading partners, including the UAE, Singapore, and South Africa, drove significant portions of emissions. The UAE emerged as the top emitter for arrivals, contributing 2227.3 TJ in energy demand and 172,464.3 tonnes of CO2.

4.4 Domestic Voyage Inventories

The domestic voyage inventories covers shipping activity between Kenyan ports along the coast and on inland waterways. Domestic voyages are analysed by vessel type and by port pair, providing insight into the structure and emissions profile of coastal and inland shipping. Although domestic shipping contributes a smaller overall share of total maritime emissions compared to international shipping, understanding its composition is essential for developing comprehensive national decarbonization strategies and addressing emissions on key coastal routes.

Table 7: Domestic Inventory by Vessel Type

Domestic Inventory							
Vessel Type	**n_vys**	**n_imo**	**aby_dwt_nm**	**tps_dwt_nm**	**ene_tj**	**co2_t**	**co2_g_p_dwtnm**
Bulk carrier	8	2	2015	30279526.8	40	3004.2	99.2
Ro-Ro	15	2	1981.4	4219531.7	28.2	2117.1	501.7
General cargo	19	5	2009.8	48795205.9	19	1428.3	29.3
Oil tanker	5	3	2005	221235450.1	16.6	1287.3	5.8
Chemical tanker	3	2	2014.5	107627222.7	8.7	675.3	6.3
Service - other	13	2	1989.2	876960.2	8.7	652.2	743.8
Container	4	4	2003.5	28274424.3	5.1	394.8	14
Liquefied gas tanker	1	1	2002	3209117.3	1.2	88.9	27.7
Vehicle	1	1	2004	6332638.1	1	73.8	11.7
Service - tug	1	1	1981	11148.8	0.2	18	1615.6
Total	**70**	**23**	**n/a**	**450,861,226**	**129**	**9,740**	**n/a**

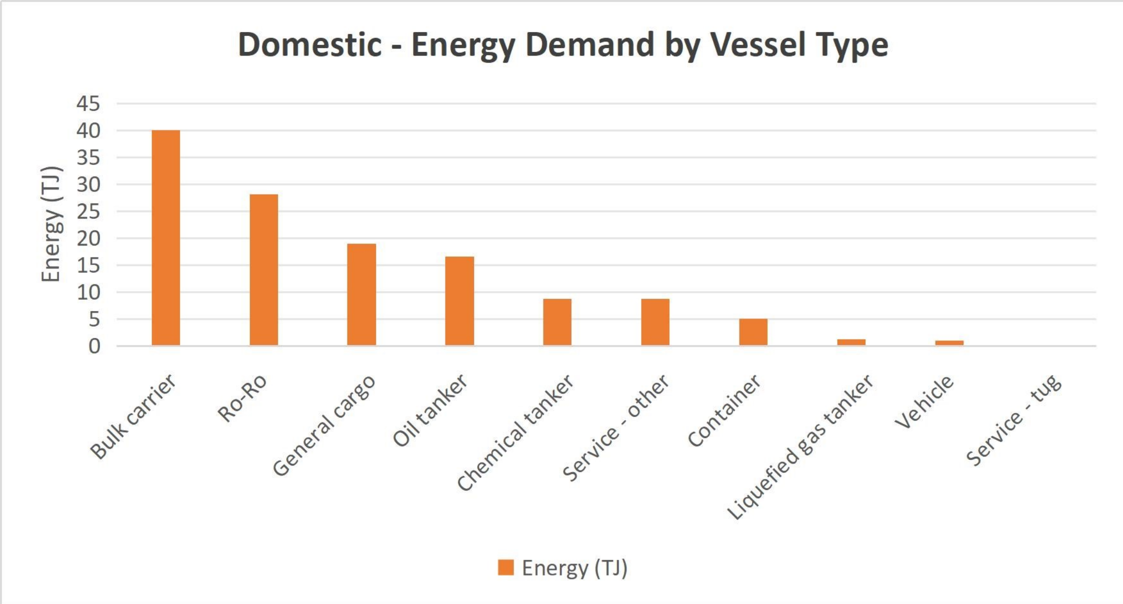

Figure 13: Graph showing Energy Demand by Vessel Type for Domestic Vessels

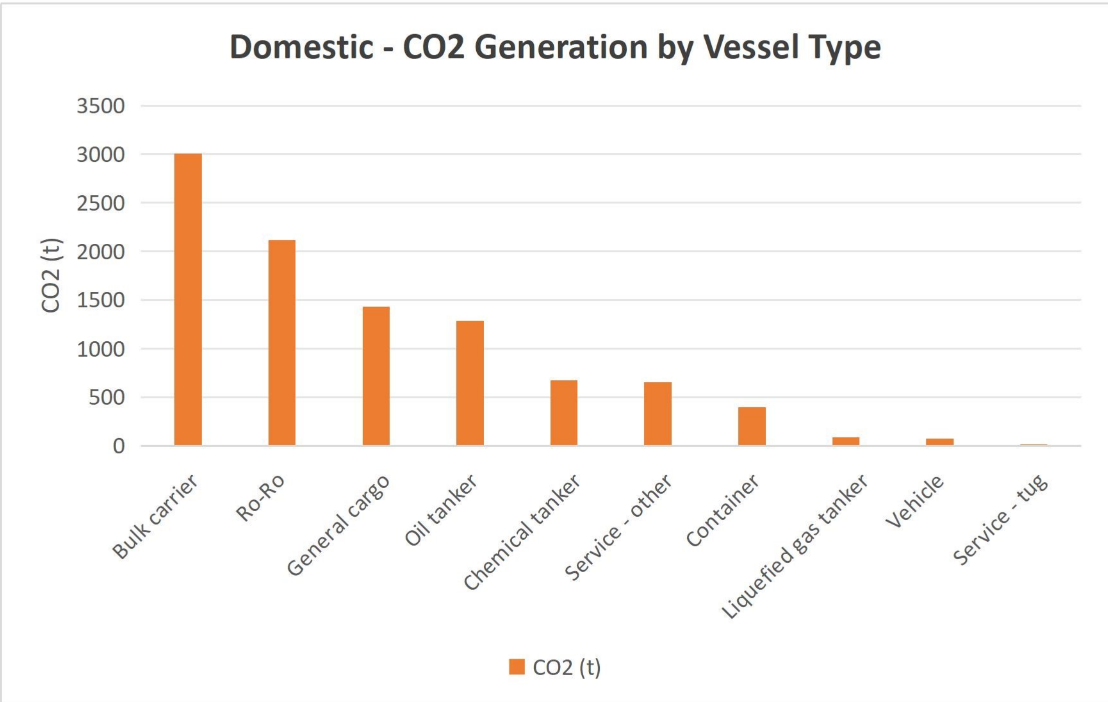

Figure 14: Graph showing Carbon dioxide Generation by Vessel Type for Domestic Vessels

Table 8: Domestic Inventory by Port Pair

Domestic Inventory							
Port Pair	**n_v ys**	**n_i mo**	**aby_dwt_ nm**	**tps_dwt_nm**	**ene_tj**	**co2_t**	**co2_g_ p_dwt nm**
Mombasa - Lamu	29	11	2006.9	47223869.7	60.4	4540.5	96.1
Malindi - Lamu	15	5	2014.9	35496962.1	31.2	2344.2	66
Mombasa - Malindi	12	7	2004.2	201543022.7	17.8	1378.6	6.8
Mombasa - Shimoni	12	9	2011.6	166415304.1	17	1310.4	7.9
Lamu - Shimoni	2	1	1996	182067.2	2.2	166.3	913.4
Total	**70**	**n/a**	**n/a**	**450,861,226**	**129**	**9,740**	**n/a**

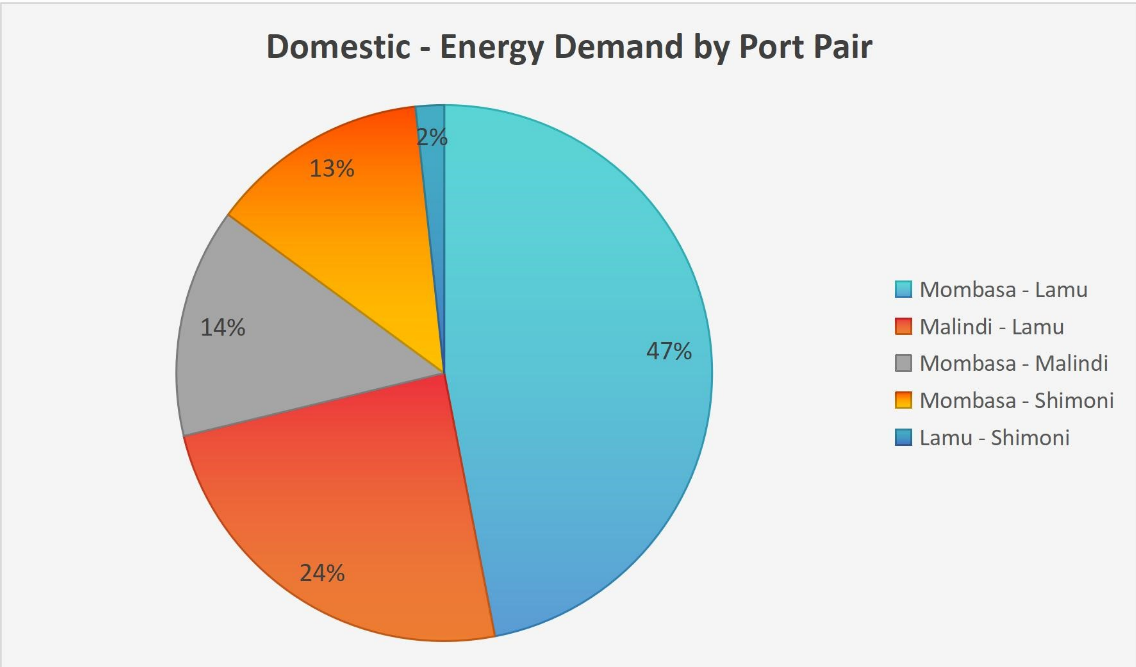

Figure 15: Visualization of Energy Demand by Port Pair

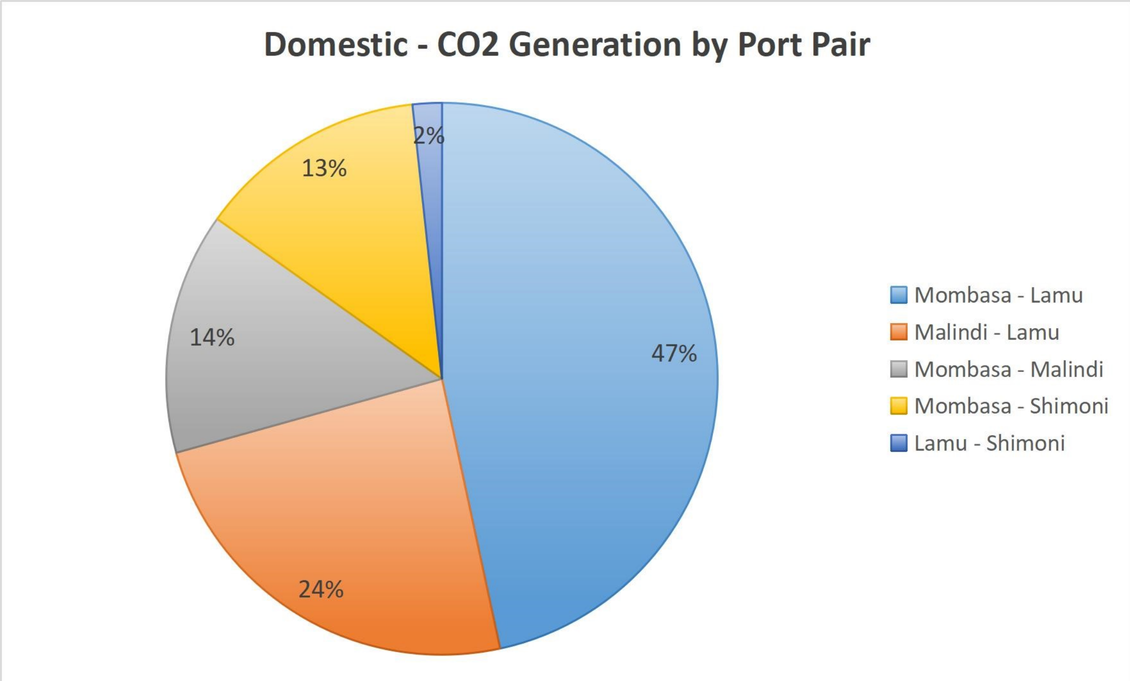

Figure 16: Visualization of Carbon Dioxide Generation by Port Pair

Domestic shipping primarily involves smaller vessels with lower overall emissions. However, routes between Mombasa and Lamu exhibited the highest energy demand (60.4 TJ) and CO_2 emissions (4540.5 tonnes), driven by the increasing utilization of these ports.

Coastal shipping's potential for decarbonization remains significant, given the concentrated emissions on a few key routes.

5. Conclusion

This report provides critical insights into Kenya's maritime transport emissions, highlighting the prominent role of international and domestic shipping in contributing to energy demand and GHG emissions. The analysis underscores several key findings:

1. International Shipping inventories portray that container ships, bulk carriers, and oil tankers dominate CO_2 emissions, with Mombasa as the primary port driving energy demand and emissions. Decentralizing port activities and enhancing operational efficiencies could significantly mitigate emissions.
2. The greatest percentage of emissions is from International Shipping. This is because most vessels visiting the Kenyan Ports are foreign vessels using conventional fuels as a means of propulsion. In comparison with international shipping, domestic shipping plays insignificant role to shipping emissions.
3. In domestic shipping, coastal routes, particularly between Mombasa and Lamu, exhibit high energy demands and emissions, presenting opportunities for decarbonization through targeted interventions.
4. The need for strategic partnerships with key trading partners, such as the UAE and Singapore, who contribute substantially to emissions could be strengthened through collaborations and adoption of sustainable shipping practices to reduce emissions along these trade routes.
5. Policy Implications - By leveraging the results of this inventory, Kenya can develop robust policies to enhance port efficiency, promote cleaner fuels, and support the transition to a decarbonized maritime sector.

Kenya's proactive stance in aligning its maritime activities with global sustainability goals positions it as a leader in Africa's maritime decarbonization efforts. The findings in this report provide a foundation for informed decision making, ensuring that Kenya's maritime sector evolves sustainably while contributing to global climate action.

Effective Afrocentric Participation (LEAP) at the IMO is essential to securing an equitable energy transition. Kenya's proactive measures, supported by rigorous technical analysis, position the nation as a key player in driving sustainable maritime practices.